

National Transportation Safety Board

Office of Research and Engineering

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COCKPIT VOICE RECORDER

Group Chair's Factual Report

November 10, 2022

WARNING

The reader of this report is cautioned that the summary and transcript of a cockpit voice recorder audio recording is not a precise science but is the best product possible from a National Transportation Safety Board group investigative effort. The summary and transcript or parts thereof, if taken out of context, could be misleading. The summary and transcript should be viewed as an accident investigation tool to be used in conjunction with other evidence gathered during the investigation. Conclusions or interpretations should not be made using the summary and transcript as the sole source of information.

A. INCIDENT

Location: Tulsa, Oklahoma
Date: June 8, 2022
Time: 0415 central daylight time (CDT)
Airplane: FedEx Express, B757-236, N949FD, FDX1170

B. COCKPIT VOICE RECORDER GROUP

Group Chair	Michael Portman Aerospace Engineer - Recorder Specialist National Transportation Safety Board (NTSB)
Group Member	Steven Smith Mechanical Engineer - Recorder Specialist NTSB
Group Member	David Keenan Senior Air Safety Investigator Federal Aviation Administration (FAA)
Group Member	Rich Lee Safety Pilot The Boeing Company
Group Member	Scott Reeves 757/767 Captain FedEx Express
Group Member	Albert Garcia 757 Crew Member (FedEx) Air Line Pilots Association (ALPA)

C. FEDERAL CARRIAGE REQUIREMENTS

Per federal regulation, turbine engine powered aircraft operating under Title 14 *Code of Federal Regulations* (CFR) Part 121 must be equipped with a cockpit voice recorder (CVR) that records a minimum of the last 2 hours of aircraft operation; this is accomplished by recording over the oldest audio data. When the CVR is deactivated or removed from the airplane, it retains only the most recent 2 hours of CVR operation.

D. DETAILS OF THE INVESTIGATION

A CVR group was convened on July 13, 2022. The NTSB Vehicle Recorder Division received the following CVR:

Recorder Manufacturer/Model: GE (Smiths Industries) CVFDR 175497
Part Number: 175497-01-01
Recorder Serial Number: 0000638

1.0 Recorder Description

This model CVR, the GE (Smiths Industries) CVFDR 175497, records a minimum of 120 minutes of digital audio stored on solid state memory modules. Four channels are recorded: one channel for each flight crew, one channel for a cockpit observer, and one channel for the cockpit area microphone (CAM).

1.1 Recorder Damage

Upon arrival at the laboratory, it was evident that the CVR had not sustained any heat or structural damage and the audio information was extracted from the recorder normally, without difficulty.

1.2 Audio Recording Description

Each channel's audio quality is indicated in Table 1.¹ Channel number one did not contain any audio information (nor was it required by federal regulations).

Table 1. Audio Quality.

Channel Number	Content/Source	Quality	Duration (hh:mm:ss)
1	Observer	N/A	02:00:10
2	First Officer	Excellent	02:00:10
3	Captain	Excellent	02:00:10
4	CAM	Good	02:00:10

1.3 Timing and Correlation

Timing on the transcript was established by correlating the CVR events to common events on the flight data recorder (FDR). Specifically, the last six radio transmissions that the aircraft made were correlated to the radio transmit microphone key parameter from the FDR. Each of the six radio transmissions acted as an anchor point for a linear interpolation between the remaining CVR events. Once a correlation between the two recorders was established, a reference to local time was

¹ Appendix A comprises the CVR Quality Rating Scale.

determined. The CVR and FDR times were offset to reflect the local time of the accident, central daylight time (CDT).

1.4 Description of Audio Events

The recording and transcript began at 0306:49 with the aircraft being loaded and pre-flighted. The aircraft was pushed back at 0323:48 and engines were started shortly thereafter. The aircraft taxied to the runway and was then cleared for takeoff at 0332:11. The flight began its descent into Tulsa at 0349:58. Subsequently, the flight was cleared for a visual approach and cleared to land on runway 18L at 0407:25. Touchdown occurred at 0412:53 and the aircraft then taxied to parking. The transcript ended at 0421:52, shortly after the aircraft parked.

The remainder of the recording consisted of the crew completing various shutdown related activities and then deboarding the aircraft. There were background sounds consistent with the aircraft being unloaded while the flight deck was unoccupied. The recording ended at 0506:59.

As part of the Safety Board's accident investigation process, the flight crew was invited to review the CVR transcript and suggest corrections or additions. As of the publishing of this report, they have not responded to the invitation.

Submitted by:

Michael Portman
Aerospace Engineer – Recorder Specialist

APPENDIX A. CVR QUALITY RATING SCALE

The levels of recording quality are characterized by the following traits of the cockpit voice recorder information:

Excellent Quality Virtually all of the crew conversations could be accurately and easily understood. The transcript that was developed may indicate only one or two words that were not intelligible. Any loss in the transcript is usually attributed to simultaneous cockpit/radio transmissions that obscure each other.

Good Quality Most of the crew conversations could be accurately and easily understood. The transcript that was developed may indicate several words or phrases that were not intelligible. Any loss in the transcript can be attributed to minor technical deficiencies or momentary dropouts in the recording system or to a large number of simultaneous cockpit/radio transmissions that obscure each other.

Fair Quality The majority of the crew conversations were intelligible. The transcript that was developed may indicate passages where conversations were unintelligible or fragmented. This type of recording is usually caused by cockpit noise that obscures portions of the voice signals or by a minor electrical or mechanical failure of the CVR system that distorts or obscures the audio information.

Poor Quality Extraordinary means had to be used to make some of the crew conversations intelligible. The transcript that was developed may indicate fragmented phrases and conversations and may indicate extensive passages where conversations were missing or unintelligible. This type of recording is usually caused by a combination of a high cockpit noise level with a low voice signal (poor signal-to-noise ratio) or by a mechanical or electrical failure of the CVR system that severely distorts or obscures the audio information.

Unusable Crew conversations may be discerned, but neither ordinary nor extraordinary means made it possible to develop a meaningful transcript of the conversations. This type of recording is usually caused by an almost total mechanical or electrical failure of the CVR system.

APPENDIX B. CVR TRANSCRIPT

The following is a transcript of a GE (Smiths Industries) CVFDR 175497 solid state cockpit voice recorder, serial number 0000638, installed on a FedEx Express Boeing 757-236 N949FD, which landed on the wrong runway on June 8, 2022, at Tulsa International Airport in Tulsa, Oklahoma.

LEGEND

AFW	Radio transmission from Fort Worth Alliance airport tower controller
APR	Radio transmission from the Tulsa approach controller
CAM	Cockpit area microphone voice or sound source
CTR	Radio transmission from the Fort Worth center controller
DEP	Radio transmission from the Regional departure controller
EGPWS	Enunciation from the Enhanced Ground Proximity Warning System (EGPWS)
HOT	Flight crew audio panel voice or sound source
INT	Outgoing intercom transmissions from N949FD
PUSH	Incoming transmissions from the external pushback crew
RAAS	Enunciation from the Runway Awareness and Advisory System (RAAS)
RAMP	Radio transmissions from the FedEx ramp controller at AFW
RDO	Radio transmissions from N949FD
TUL	Radio transmission from the Tulsa airport tower controller
-1	Voice identified as the captain
-2	Voice identified as the first officer
-3	Voice identified as a FedEx AFW gate agent
-?	Voice unidentified
*	Unintelligible word
#	Expletive
@	Non-pertinent word
()	Questionable insertion
[]	Editorial insertion

Note 1: Times are expressed in central daylight time.

Note 2: Generally, only radio transmissions to and from the accident aircraft were transcribed.

Note 3: Words shown with excess vowels, letters, or drawn-out syllables are a phonetic representation of the words as spoken.

Note 4: A non-pertinent word, where noted, refers to a word not directly related to the operation, control, or condition of the aircraft.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0306:49.0	START OF RECORDING START OF TRANSCRIPT		
0309:39.6	[sound of ACARS chime]		
CAM			
0309:42.3	could it be? is it she?		
CAM-1			
0309:45.7	all right man one...eleven seventy (ninety/eighty) eight...fuel twenty five eight...**...cargo's light by about seven thousand pounds...**...aft C-G which I can tell you by looking how long the aleo ² is extended down there... [discussing weight and balance]		
CAM-2			
0310:19.0	well when they finish loading the airplane it'll be a little bit more forward than it is right now.		
CAM-1			
0310:27.2	[non-pertinent conversation]		
CAM			
0311:41.2	[crew completed standard performance brief, including a Vref of 125 knots]		
CAM			

² Pronouncing oleo, referring to an oleo strut, a type of shock absorber found on landing gear of many aircraft.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0314:01.8 CAM	[captain enunciated the cockpit setup for the departure]		
0314:40.1 CAM-2	it looks like they have all our cans out here now...two three and four are void.		
0314:54.3 CAM-2	probably push for a golf exit...that's the normal around here.		
0315:02.4 CAM-1	yep.		
0315:04.5 CAM-1	why don't we do the ever famous much maligned before start checklist *.		
0315:08.3 CAM-1	[crew began the before start checklist]		
0315:30.7 CAM	[sounds of knocking]		
0315:32.3 CAM-2	come in.		
0315:32.5 CAM-1	come on...just pull on it.		
0315:37.8 CAM	[sounds of latching]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0315:39.3 CAM	[miscellaneous discussion with the gate agent]		
0316:15.4 CAM	[sound of latching]		
0316:34.1 CAM	[miscellaneous latching sounds]		
0316:35.2 CAM-1	are we catered on this one?		
0316:36.4 CAM-2	no.		
0316:41.7 CAM-2	it's so rare anymore that we don't have food on every flight.		
0316:44.7 CAM-1	yeah.		
0316:46.5 CAM-1	I've had them cater this flight before just 'cause they were just...they were cater happy.		
0316:50.9 CAM-2	yeah.		
0316:52.9 CAM-?	[sound of sigh]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0316:56.0 CAM-1	let's see...Alliance...Tulsa...that's us...that's our tail number...we got two hundred kilograms of dry ice...we have a radioactive material...		
0317:20.0 CAM-1	* eight...eight left...		
0317:26.2 CAM	[sound of click]		
0317:53.5 CAM-2	** concur.		
0318:06.7 CAM-2	well it's starting to cool off in here a little bit.		
0318:53.5 CAM-?	[sound of yawn]		
0318:56.0 CAM-2	almost there.		
0318:57.9 CAM-1	yeah.		
0319:07.1 CAM-1	hold the beacon. [referring to radio traffic]		
0319:08.2 CAM-2	...there's the tug for us...I think...		
0319:12.8 CAM-2	you thinks methinks?		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0319:16.0 CAM-?	come on.		
0319:17.9 CAM-2	could it be?		
0319:22.8 CAM-1	oh oui but of course.		
0319:25.4 CAM-?	sacre bleu!		
0319:26.7 CAM-?	invaders!		
0319:43.2 CAM	[non pertinent conversation]		
0320:08.2 CAM	[sound of latching]		
0320:12.2 CAM-1	hi.		
0320:13.6 CAM-3	has the * all loaded [additional unintelligible conversation] can we get the pumps.		
0320:19.8 CAM-2	we need a final...final weight and balance.		
0320:22.7 CAM-1	it's on.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0320:34.1 CAM	[various sounds of clicking]		
0321:08.1 CAM	[sound of ACARS chime]		
0321:09.8 CAM-1	go.		
0321:10.5 CAM-2	there it is...our final.		
0321:12.8 CAM-1	yep...looks the same.		
0321:15.8 CAM-1	fifty five thirty one two's (it/in).		
0321:20.1 CAM-2	yep.		
0321:21.0 CAM-1	close enough.		
0321:22.3 CAM-2	kay.		
0321:22.8 CAM-1	yep.		
0321:24.1 CAM-1	send it away...give them the boot.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0321:27.2 CAM-2	alrighty.		
0321:28.0 CAM	[sounds of various clicking and latching]		
		0321:38.3 RDO-1	Alliance FedEx eleven seventy at gate seventeen request the beacon and push.
		0321:43.4 RAMP	eleven seventy beacon is approved hold push.
		0321:46.8 RDO-1	beacon but hold the push seven– eleven seventy.
0321:52.9 CAM	[sound of thunking]		
0322:31.1 CAM	[miscellaneous sounds of clicking and latching]		
0322:44.2 CAM-1	we've got a beacon and hold the push.		
0322:46.2 CAM-2	alrighty.		
0322:47.3 CAM	[miscellaneous sounds of clicking and latching]		
0323:00.7 HOT-1	[sound of breathing]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0323:04.0 HOT-1	when you're ready you can go below the line.		
0323:07.8 CAM-2	all right...before start...below the line. [first officer continues before start checklist]		
		0323:19.7 RAMP	all right eleven seventy push approved for golf exit abeam gate sixteen...one six.
		0323:25.3 PUSH	ground to flight deck.
		0323:25.4 RDO-2	clear for push abeam sixteen and (spot golf).
		0323:26.7 INT-1	hello.
		0323:28.0 PUSH	hello sir walkarounds complete all doors verified closed and locked pitot covers are removed we're standing by for push.
		0323:33.2 INT-1	doors are closed up here the parking brake is set we're cleared to push and they want you to pull us abeam gate sixteen.
		0323:38.9 PUSH	copy that clear to push and pull up agea– abeam gate sixteen...go ahead and release your brakes.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		0323:44.8 INT-1	parking brake released.
0323:47.2 HOT-2	[sound of sigh]		
		0323:47.6 RAMP	copy brakes released here we go and you're cleared for engine start your discretion.
		0323:50.8 INT-1	all right...starting them up.
0323:52.6 HOT-1	start the left...then the right.		
0323:56.8 CAM	[various sounds of clicking and latching]		
0324:21.4 HOT-2	[sound of sigh]		
0324:57.1 CAM	[sounds of various button pushing and switching]		
0325:09.5 HOT-1	the other day they pushed me out here...couple weeks ago...had me perfectly lined up on the grate over there.		
0325:15.3 HOT-2	hehe.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0325:17.0 HOT-1	just dead on it...okay.		
		0325:42.4 PUSH	alrighty sir please set brakes.
		0325:46.0 INT-1	parking brake set.
		0325:53.2 PUSH	towbar disconnected bypass pin is removed we're standing by.
		0325:56.9 INT-1	all right we're on our way to two good engine starts...you're cleared to disconnect...thanks for everything.
		0326:00.3 PUSH	copy that have a good flight two exiting on your right hand side.
		0326:03.2 INT-1	alrighty we'll look for ya.
0326:04.8 HOT-1	after start flaps five.		
0326:06.0 CAM	[sounds of levers and switches]		
0326:16.6 HOT-2	after start checklist engine anti ice.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0326:18.0 HOT-1	off.		
0326:18.4 HOT-2	after start checklist complete.		
0326:19.1 CAM	[sound of lever]		
		0326:21.6 RDO-2	ramp eleven seventy...
0326:23.8 HOT-2	oh sorry thanks.		
		0326:28.2 RAMP	aircraft calling Alliance...
0326:30.3 HOT-2	ready to go.		
0326:31.7 HOT-1	since they're behind the line...there we go...yep.		
		0326:33.9 RDO-2	ramp eleven seventy taxi.
		0326:35.5 RDO-2	sorry about that.
0326:36.0 HOT-1	[sound of breathing]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		0326:36.8 RAMP	eleven seventy taxi to golf switch over to ground and have a good mornin'.
		0326:40.5 RDO-2	and we're going out golf and we'll see ya later eleven seventy.
0326:43.5 HOT-2	all right we're clear on the right.		
0326:45.7 HOT-1	all right here we go.		
0326:47.5 HOT-1	I have built over time a series of hooks...that I don't do one thing until I've completed the previous thing...and the biggest one is...this light stays on until I get a wave off.		
0327:00.4 HOT-2	got it.		
0327:01.1 HOT-1	I don't taxi until that light goes off.		
0327:03.6 HOT-2	I mean—		
0327:03.7 HOT-1	umm...and it's just...		
0327:05.2 HOT-2	yeah keep you from running someone over.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0327:05.7 HOT-1	I— I have...I almost ran over a guy one time...in a hurry...ya know...tired...um...he disconnected the towbar and had a problem hooking the thing back up to the tug to drive away...so it had been several minutes and uhh I turn on the landing light and I see these two dudes # go scrambling out it's like oh #...okay...yep...@ gonna slow her down.		
		0327:39.1 RDO-2	ground good morning FedEx eleven seventy coming out golf with lima.
0327:48.2 HOT-2	oops let's try it on this one now.		
0327:51.2 HOT-1	'kay.		
		0327:52.8 RDO-2	ground good morning FedEx eleven seventy uhh on golf with lima.
		0327:57.6 AFW	FedEx eleven seventy Alliance ground runway one six left taxi via golf alpha advise when you have mike.
		0328:05.1 RDO-2	'kay we're going to one six left via golf alpha and I'll grab mike FedEx eleven seventy.
0328:19.6 HOT-1	all right (we/you) can do the before takeoff checklist.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0328:21.1 HOT-2	all right gimme one second uhhhhhh...why wouldn't it be on there...		
0328:31.5 HOT-2	it's twenty six ninety five...		
0328:45.9 HOT-2	two six nine two five...		
0328:50.2 CAM	[ATIS information mike winds 170 at 9 knots gusts to 20 knots, visibility 10 miles, clouds 25,000 feet broken, temperature 27 dewpoint 22 altimeter 29.81 inHg, visual approach runway 16L with various NOTAMs]		
0328:51.6 CAM	*** bottoms are yours ***. [unintelligible conversation obscured by ATIS]		
0329:23.1 HOT-2	all right before takeoff checklist...flaps...five.		
0329:28.5 HOT-1	checked.		
0329:29.2 HOT-2	flight controls.		
0329:30.0 HOT-1	checked.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0329:30.4 HOT-2	checked...trim is zero...zero...three point two five.		
0329:35.6 HOT-1	checked.		
0329:36.5 HOT-2	autobrakes.		
0329:37.7 HOT-1	R-T-O.		
0329:38.9 HOT-2	briefing.		
0329:39.5 HOT-1	it's complete for one six left unless you have any questions.		
0329:42.9 HOT-2	none.		
0329:43.2 HOT-1	the altimeter was uhh...two nine eight one.		
0329:44.9 HOT-2	two nine eight one.		
0329:45.8 HOT-1	aight.		
0329:46.5 HOT-2	we're to the line.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0329:47.7 HOT-1	excellent.		
		0329:52.1 RDO-2	ground FedEx eleven seventy has mike.
		0329:54.5 AFW	FedEx eleven seventy roger.
0330:01.8 HOT-2	[sounds of humming]		
0330:32.9 HOT-1	warm up's good.		
0330:33.5 CAM	[sounds of clicking]		
0330:36.3 HOT-2	goooooood.		
0331:02.1 HOT-2	aright we're up tower...departure's on the flip flop...guard's on *.		
		0332:11.3 AFW	FedEx eleven seventy Alliance Tower runway one six left. clear for takeoff. wind at one six zero at seven.
		0332:18.6 RDO-2	FedEx eleven seventy cleared for takeoff one six left.
0332:21.3 HOT-1	below the line for one six left.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0332:23.7 HOT-2	all right before takeoff below line takeoff configuration is check v-speeds.		
0332:29.1 HOT-1	checked.		
0332:29.8 HOT-2	checked...M-C-P.		
0332:31.0 HOT-1	one forty one. heading one seventy five. five thousand set.		
0332:36.8 HOT-2	before takeoff checklist complete.		
0332:46.9 RAAS	approaching one six left. [electronic voice]		
0332:49.3 HOT-2	final's clear.		
0332:55.4 HOT-1	runway's clear.		
0333:11.3 HOT-1	you ready?		
0333:12.0 HOT-2	yes sir one six left's verified.		
0333:14.0 RAAS	on runway one six left. [electronic voice]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0333:17.3 HOT-1	arright set thrust.		
0333:20.4 CAM	[increase in engine pitch consistent with applying takeoff thrust]		
0333:26.1 HOT-2	thrust set.		
0333:29.7 HOT-2	eighty knots.		
0333:30.4 HOT-1	checked.		
0333:42.9 HOT-2	vee one.		
0333:43.6 HOT-2	rotate.		
0333:52.4 HOT-2	positive rate.		
0333:53.3 HOT-1	gear up.		
0333:54.2 CAM	[sounds of levers]		
0334:02.5 HOT-1	heading select.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0334:03.7 CAM	[sounds similar to landing gear retraction]		
		0334:06.6 AFW	FedEx eleven seventy contact regional departure good morning.
		0334:10.1 RDO-2	eleven seventy switching departure g'day.
0334:12.0 HOT-1	v-nav.		
0334:16.3 HOT-1	flaps one.		
0334:17.1 CAM	[sounds of lever]		
0334:22.5 HOT-1	flaps up after takeoff checklist.		
0334:23.4 CAM	[sounds of levers and switches]		
		0334:27.1 RDO-2	departure good morning FedEx eleven seventy two point two for five thousand.
0334:37.1 CAM	[sound of chime]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		0334:37.3 RDO-2	departure FedEx eleven seventy two point four for five thousand.
		0334:40.5 DEP	FedEx eleven seventy departure radar contact climb and maintain seven thousand what's your destination?
		0334:46.1 RDO-2	seven thousand goin' to Tulsa.
		0334:49.1 DEP	FedEx eleven seventy turn right heading three two zero.
		0334:53.1 RDO-2	right three two zero FedEx eleven seventy.
0335:03.3 HOT-2	after takeoff checklist complete.		
0335:05.2 HOT-1	thank you.		
0335:07.1 HOT-2	verify seven thousand.		
0335:08.2 HOT-1	seven thousand.		
		0335:19.4 DEP	FedEx eleven seventy turn right direct Tulsa climb and maintain eight thousand.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		0335:23.6 RDO-2	direct Tulsa up to eight thousand FedEx eleven seventy.
0335:28.3 HOT-2	there's eight.		
0335:29.4 HOT-1	eight I see.		
0335:30.1 HOT-2	there's Tulsa for now.		
0335:32.0 HOT-1	'kay that'll work...execute L-NAV.		
0335:34.4 HOT-2	L-NAV's available.		
0335:35.8 HOT-1	L-NAV.		
0335:36.6 HOT-2	arright...[sigh]...let me get you the...		
0335:45.2 HOT-2	I-D-W-E.		
0335:54.8 HOT-2	I-D-W-E is the ...I-L-S.		
0335:57.3 HOT-1	aright.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0335:58.5 HOT-2	you good with that?		
0335:59.1 HOT-1	yep.		
0335:59.7 HOT-2	uhhhhh...I'm gonna change that guy...put him there...		
		0336:03.3 DEP	FedEx eleven seventy climb and maintain niner thousand.
		0336:06.9 RDO-2	nine thousand now FedEx eleven seventy.
0336:08.8 HOT-1	niner.		
0336:09.8 HOT-2	all right so there's (the spot) and then uhh the I-L-S.		
0336:13.8 HOT-1	that works.		
0336:17.4 HOT-2	pumps are zero...they're comin' off.		
0336:19.0 HOT-1	'kay.		
0336:53.9 HOT-2	(comin up/we're about) eight for nine.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0336:55.8 HOT-1	thank you.		
0336:58.5 CAM	[altitude alert]		
0337:46.3 HOT-1	autopilot's on.		
0337:47.3 HOT-2	see it.		
		0337:55.7 DEP	FedEx eleven seventy climb and maintain one seven thousand.
		0337:58.7 RDO-2	one seven thousand FedEx eleven seventy.
0338:01.2 HOT-2	seventeen.		
0338:03.0 HOT-?	speed (mode).		
0338:16.7 HOT-1	[cough]		
		0338:24.9 DEP	FedEx eleven seventy contact Fort Worth Center one two four point seven five.
		0338:29.2 RDO-2	twenty four seventy five thanks FedEx eleven seventy g'day.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		0338:37.3 RDO-2	center good morning FedEx eleven seventy ten point one for seventeen thousand.
		0338:41.7 CTR	FedEx eleven seventy Fort Worth climb and maintain flight level tree one zero.
		0338:45.0 RDO-2	three one zero FedEx eleven seventy.
0338:53.0 HOT-2	thirty one.		
0338:55.5 HOT-1	goin' climb one.		
0338:59.8 HOT-1	I wanna reach top of climb before top of descent.		
0339:03.6 HOT-2	all right Tulsaaaa...winds are light outta the south scattered at five thousand usin' one eights...that's interesting tower's one eight eight seven on the frequency that's gonna be hard.		
0339:25.9 HOT-1	yeah that's not right.		
0339:27.2 HOT-2	hehe.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0339:29.2 HOT-2	uhh...all arrivals...approach is...one twenty four...sure...okay.		
0340:33.7 HOT-1	goin' to full climb.		
0340:35.0 HOT-2	'kay.		
0340:49.8 HOT-2	and one seventy five three for weight.		
0340:53.6 HOT-1	aright I like that.		
0340:57.9 HOT-1	one two three?		
0340:59.0 HOT-2	yessir.		
0340:59.8 HOT-1	perfect.		
		0342:01.5 CTR	and FedEx eleven seventy if you're not doing it already cleared direct Tulsa airport.
		0342:05.3 RDO-2	we're cleared direct Tulsa already sir and we're n-uhh...we're heading that way.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0342:15.6 HOT-2	two nine eight six.		
0342:22.7 HOT-1	standard altimeter.		
0342:24.1 HOT-2	standard on the right.		
0342:49.1 HOT-2	uhhh...six point nine five point five for one eight and then we're going to the end of it.		
0342:55.7 HOT-1	all right brakes off.		
0342:56.8 HOT-2	'kay.		
0343:48.5 HOT-1	gahhh...[sound of sigh]		
0344:04.1 HOT-1	gotta point...thirty miles short at eleven thousand feet.		
0344:08.7 HOT-2	aright.		
0344:21.6 HOT-2	spot three.		
0344:23.6 HOT-1	aright.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0344:25.5 HOT-2	with power.		
0344:49.6 HOT-1	[sound of yawn]		
0345:53.5 HOT-1	[sound of sigh]		
0346:35.8 HOT-1	[sound of yawn]		
0347:10.1 HOT-1	[sound of yawn]		
0347:29.4 HOT-1	all right I got one oh nine seven...one eighty...		
0347:32.0 HOT-2	okay.		
0347:34.4 HOT-1	twenty four hundred at OWASO going down to eight forty one.		
0347:39.7 HOT-2	yep.		
0347:39.8 HOT-1	two hundred foot MALSR PAPI left.		
0347:43.4 HOT-1	brakes off roll to the end...turn left.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0347:46.4 HOT-2	okay.		
0347:48.9 HOT-1	questions?		
0347:49.7 HOT-2	no.		
0348:02.5 HOT-1	[sound of cough]		
0348:21.3 HOT-1	[sound of yawn]		
0348:39.5 HOT-1	[sound of cough]		
0348:52.4 CAM	[altitude alert]		
0348:53.9 HOT-2	thirty for thirty one.		
0348:55.8 HOT-1	one to go.		
0349:02.1 HOT-2	there's path.		
0349:04.9 HOT-2	thirty five miles at altitude hahaha.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0349:08.4 HOT-1	what's that?		
0349:09.5 HOT-2	we'll be at altitude for four minutes.		
0349:11.4 HOT-1	yep.		
		0349:58.0 CTR	FedEx eleven seventy descend maintain one zero thousand the uhh...I'll get you Tulsa altimeter here in just a second.
		0350:05.0 RDO-2	all right FedEx eleven seventy out of uh three one zero for one zero thousand.
0350:16.9 HOT-2	ten thousand.		
0350:22.4 HOT-1	[sound of cough]		
0350:44.6 HOT-1	the lights of home over there...what's say we divert now?		
0350:49.2 HOT-2	hehe.		
		0351:08.1 CTR	FedEx eleven seventy the uhh...the Tulsa altimeter's two niner eight six.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		0351:13.6 RDO-2	two nine eight six for Tulsa FedEx eleven seventy.
0351:16.1 HOT-2	all right we're cleared to ten thousand...I don't think it's uhh...descend now...right?		
0351:22.5 HOT-1	okay.		
0351:23.7 HOT-2	yeah.		
0351:24.4 HOT-2	aaaand...we're leaving thirty one.		
		0351:37.0 RDO-2	FedEx eleven seventy's out of uh three one zero.
0351:53.2 HOT-2	all right it looks like the action on the radar's that stuff over there...[sigh]		
0351:59.6 HOT-1	yeah.		
0352:00.1 HOT-2	doesn't look too bad on the nose.		
0352:07.4 HOT-1	should not be a factor.		
0352:11.8 HOT-1	[sound of cough]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0352:34.5 HOT-2	[sound of snuffle]		
0353:09.8 HOT-1	[sound of yawn]		
0353:12.0 HOT-1	a little bit of lightning over there.		
0353:24.1 HOT-1	[sound of cough]		
0353:49.2 HOT-1	on the pathway to happiness.		
0354:15.5 HOT-2	ahem.		
0354:41.6 HOT-2	where's Sheppard is out out here in Tulsa?		
0354:44.2 HOT-1	Sheppard? no it's down in Wichita Falls.		
0354:46.5 HOT-2	okay.		
0355:03.9 HOT-1	[sound of clearing throat]		
0355:06.7 HOT-1	Tulsa's got an eff sixteen guard unit.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0355:09.3 HOT-2	yep...yeah...I've done a flight with those guys.		
0355:26.8 HOT-1	[sound of throat clearing]		
0356:38.9 HOT-1	[sound of throat clearing]		
0357:25.9 HOT-1	in range please...ahem.		
0357:38.6 HOT-2	in range checklist...altimeter's two nine eight six.		
0357:42.0 HOT-1	two nine eight six.		
		0357:43.2 CTR	FedEx eleven seventy contact Tulsa Approach one two four point zero.
0357:43.4 HOT-2	landing data.		
		0357:47.0 RDO-2	twenty four oh FedEx eleven seventy.
0357:54.9 HOT-2	I'm sorry landing data.		
0357:56.0 HOT-1	it's been checked.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0357:56.8 HOT-2	checked...autobrakes are...off...in range checklist complete.		
		0358:13.2 RDO-2	Tulsa good morning FedEx eleven seventy is with you sixteen point two with delta.
		0358:21.5 APR	FedEx eleven seventy Tulsa Approach expect visual approach runway one eight left descend and maintain six thousand.
		0358:26.9 RDO-2	one eight left down to six thousand now FedEx eleven seventy.
0358:31.5 HOT-2	six thousand.		
0358:33.1 HOT-1	aight I got a good ident...let's do the approach checklist.		
0358:35.5 HOT-2	approach checklist...briefing.		
0358:38.0 HOT-1	complete.		
0358:39.0 HOT-2	altimeters.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0358:39.9 HOT-1	two nine eight six.		
0358:40.8 HOT-2	two nine eight six. minimumssss...		
0358:43.3 HOT-1	eight forty one baro.		
0358:44.6 HOT-2	eight forty one baro nav aids are checked. approach checklist complete.		
0358:48.4 HOT-1	thank you.		
0358:50.4 HOT-1	missed approach will be straight ahead to three thousand feet.		
0358:54.8 HOT-2	uhhh...okay.		
0358:56.4 HOT-1	instead of the published...to Tulsa at three thousand feet.		
0400:01.3 HOT-1	*.		
0400:43.3 HOT-1	are you happy without the radar now?		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0400:45.3 HOT-2	liiii am...uhhhh that goes there...that goes...there...		
0400:56.0 HOT-1	[sound of clearing throat]		
0401:22.2 HOT-1	FLCH...FLCH'ing to six.		
0401:22.4 HOT-2	see...I see it.		
0401:26.0 HOT-1	I seen 'em.		
0401:26.9 HOT-2	I see it.		
0401:47.3 HOT-2	we bringing this jet back tomorrow...or will someone else take it?		
0401:49.7 HOT-1	nah we should bring it back.		
0401:57.2 HOT-2	[sound of snuffle]		
0402:07.9 HOT-1	and we should have just enough gas onboard when we land to bring it back.		
0402:10.6 HOT-2	yeah.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0402:18.3 HOT-1	[sound of throat clearing]		
0402:19.7 HOT-2	especially if we're going south to south.		
0402:22.6 HOT-1	yeah.		
0402:31.4 HOT-2	[sound of yawn]		
		0403:03.6 APR	FedEx eleven seventy fly heading three six zero descend and maintain three thousand five hundred.
		0403:07.4 RDO-2	three six zero down to three point five FedEx eleven seventy.
0403:11.9 HOT-2	three six zero...three point fiiiive.		
0403:16.8 HOT-1	you can give me OWASO with a tail.		
0403:18.4 HOT-2	I see it.		
0403:19.7 HOT-2	uhhhh...you want OWASO...		
0403:20.4 HOT-1	[sound of clearing throat]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0403:24.8 HOT-2	uhhhh...what is that...one eight zero...		
0403:31.7 HOT-2	how do you like that?		
0403:32.6 HOT-1	that's lovely.		
0403:33.9 HOT-2	there you go.		
0403:35.2 HOT-1	it can't get any better than that.		
0403:36.5 HOT-2	magical.		
0404:50.3 HOT-1	[sound of clearing throat]		
0404:54.7 HOT-2	[sound of snuffle]		
0405:10.6 HOT-2	[sound of clearing throat]		
		0406:02.0 APR	FedEx eleven seventy descend and maintain two thousand five hundred airport two o'clock niner miles.
		0406:06.0 RDO-2	two thousand five hundred FedEx eleven seventy.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0406:08.1 HOT-1	we will not see it.		
0406:09.8 HOT-2	we are in what is known as popeye...or I-M-C.		
0406:13.5 HOT-1	not quite even popeye we're just in the muck.		
0406:29.0 HOT-2	that's probably terms you guys don't use in the air force.		
0406:32.2 HOT-1	we use popeye.		
0406:36.3 HOT-2	navy loves that # around the boat. [sigh]		
0406:38.9 HOT-1	yeah.		
0406:43.3 HOT-2	euuuuaaghhhhh. [sigh]		
0406:45.1 HOT-1	it's right there in that dark spot is where the airport is.		
0406:48.5 HOT-1	[sound of clearing throat]		
0406:52.7 HOT-2	where is your becownn. [smacking teeth]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0407:01.8 HOT-1	there it is right there.		
0407:03.3 HOT-2	you got it?		
0407:03.9 HOT-1	yep.		
0407:04.3 HOT-2	oh yeah...uhhhhhh...		
0407:13.3 HOT-2	well...you wanna go all the way out there?		
0407:16.2 HOT-1	huh?		
0407:16.8 HOT-2	you wanna go all the way out uhh...?		
0407:18.4 HOT-1	no we're not gonna go all the way out there...you can just call it...you can call it in sight now.		
		0407:22.0 RDO-2	aaand FedEx eleven seventy field in sight.
0407:22.2 CAM	[altitude alert]		
0407:23.9 HOT-2	three point five for two point five.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		0407:25.0 TUL	FedEx eleven seventy cleared visual approach runway one eight left runway one eight left cleared to land wind zero five zero at six.
		0407:29.5 RDO-2	cleared for the visual one eight left and we're cleared to land one eight left FedEx eleven seventy.
0407:34.0 HOT-1	we're gonna go a little bit farther than this though.		
0407:35.6 HOT-2	ya...hehehe.		
0407:36.9 HOT-1	[sound of clearing throat]		
0407:50.6 HOT-2	there's alt cap...two point fiveee...		
0408:24.6 HOT-1	set flaps one.		
0408:26.1 CAM	[sounds of lever]		
0408:26.4 HOT-2	flaps one.		
0408:30.6 HOT-1	[sound of throat clearing]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0408:57.3 HOT-1	all right...flaps five.		
0408:59.2 CAM	[sounds of lever]		
0409:00.0 HOT-2	flaps five.		
0409:50.1 HOT-1	go flaps fifteen.		
0409:51.7 CAM	[sounds of lever]		
0409:51.8 HOT-2	fifteen now.		
0409:54.0 HOT-1	[sounds of throat clearing]		
0410:06.1 HOT-1	I'm in vert speed.		
0410:07.7 HOT-2	I see vert speed.		
0410:10.5 HOT-1	flaps twenty.		
0410:11.8 HOT-2	flaps twenty.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0410:12.1 CAM	[sounds of lever]		
0410:15.0 HOT-1	landing gear down before landing checklist.		
0410:16.8 CAM	[sounds of lever]		
0410:17.6 CAM	[increase in ambient noise consistent with gear down]		
0410:38.9 CAM	[sound similar to quad aural alert beeper]		
0410:41.0 HOT-1	random autopilot...we'll turn it off.		
0410:42.6 HOT-2	all right.		
0410:46.1 HOT-2	before landing checklist...speedbrake is armed.		
0410:47.9 HOT-1	checked.		
0410:48.5 HOT-2	gear's down three green.		
0410:49.8 HOT-1	checked.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0410:51.3 HOT-1	flaps twenty five.		
0410:52.5 CAM	[sounds of lever]		
0410:54.6 HOT-2	twenty five.		
0411:01.2 HOT-1	and thirty.		
0411:02.3 CAM	[sounds of lever]		
0411:07.2 HOT-2	flaps thirty.		
0411:08.5 HOT-1	checked.		
0411:09.4 HOT-2	before landing checklist complete.		
0411:10.3 CAM	[miscellaneous sounds of clicking]		
0411:18.8 HOT-1	you can bug me back a couple more knots if you don't mind.		
0411:22.6 HOT-2	oh you wanna come down? uhhhhh you want what? twenty seven?		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0411:25.9 HOT-1	yeah somethin' like that.		
0411:28.1 HOT-2	twenty eight maybe?		
0411:29.8 EGPWS	one thousand. [electronic voice]		
0411:30.4 HOT-2	if I can add five.		
0411:40.6 HOT-2	aallrright...a little bit low.		
0411:42.0 RAAS	approaching one eight right. [electronic voice]		
0411:44.4 HOT-1	eh I'm on the glideslope...pretty much.		
0411:47.9 HOT-2	yeah you are on the glideslope.		
0411:48.7 HOT-1	the PAPI's aren't...		
0411:49.5 HOT-2	PAPI's aren't coincidental.		
0411:49.8 HOT-1	coincident...yeah.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0411:52.6 HOT-1	now I'm getting a little low.		
0411:55.8 HOT-1	[sound of clearing throat]		
0412:05.9 HOT-1	a little bit of a tailwind up here it looks like.		
0412:08.7 HOT-2	yeah you got seven knots.		
0412:13.6 EGPWS	five hundred. [electronic voice]		
0412:14.6 HOT-2	you're stable. cleared to land one eight left.		
0412:18.6 HOT-1	landing.		
0412:20.7 HOT-1	glideslope shows me really high...the PAPIs show me a little low.		
0412:23.6 HOT-2	yeahhh...I'd go with the PAPI's heh.		
0412:29.1 HOT-2	feels like you're dragging it in a little bit. [sigh]		
0412:34.2 HOT-1	(and/there) the glideslope came back...it's all over the place isn't it.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0412:42.5 HOT-1	throttles are off.		
0412:46.8 EGPWS	one hundred. [electronic voice]		
0412:48.3 EGPWS	fifty. [electronic voice]		
0412:48.9 EGPWS	forty. [electronic voice]		
0412:49.8 EGPWS	thirty. [electronic voice]		
0412:50.7 EGPWS	twenty. [electronic voice]		
0412:51.7 EGPWS	ten. [electronic voice]		
0412:53.2 CAM	[sounds consistent with touchdown]		
0412:55.4 HOT-2	spoilers deployed.		
0412:55.9 HOT-1	boom.		
0412:57.4 CAM	[sounds of clicking]		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0412:59.2 RAAS	three thousand remaining. [electronic voice]		
0413:04.3 RAAS	two thousand remaining. [electronic voice]		
0413:10.3 HOT-2	ssssss...missed your eighty...here's sixty.		
0413:11.4 RAAS	one thousand remaining. [electronic voice]		
0413:13.0 CAM	[sounds of levers]		
0413:14.4 HOT-1	are we on the correct runway?		
0413:16.7 HOT-2	one eight left?		
0413:18.4 HOT-1	what the #.		
0413:20.7 HOT-1	we landed on the right runway.		
0413:23.5 HOT-1	God # @. [captain]		
0413:25.6 HOT-2	oh my God.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0413:30.9 HOT-1	okay...after landing checklist.		
0413:33.0 CAM	[miscellaneous sounds of levers]		
		0413:35.0 RDO-2	tower FedEx eleven seventy. [sigh]
		0413:39.1 RDO-2	tower FedEx eleven seventy.
		0413:40.5 TUL	go ahead.
		0413:41.6 RDO-2	yes ma'am uhhhh...we landed on one eight right...can we taxi to parking?
		0413:49.4 TUL	FedEx eleven seventy you can turn left at the end there and then left on charlie.
0413:49.7 CAM	[sounds of various levers]		
		0413:53.4 RDO-2	left and left on charlie FedEx eleven seventy.
		0413:55.7 TUL	sorry it'll be left on lima.
		0413:57.2 RDO-2	left on lima FedEx eleven seventy.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0413:59.7 HOT-2	clear...to the left...clear right. [sigh]		
0414:03.8 HOT-1	yep...after landing check.		
0414:08.0 HOT-1	I was wondering why that thing came up so short.		
0414:11.4 HOT-2	yeah.		
0414:19.9 HOT-2	what do we have in there.		
0414:21.8 HOT-1	aright.		
0414:23.6 HOT-2	one eight left.		
0414:24.0 HOT-1	that's the right one.		
0414:33.6 HOT-2	(that's/so) right there...all right where are we...let's get to the line first and figure it out...taxi...taxi...		
		0414:44.0 TUL	FedEx eleven seventy you'll turn right on charlie and then left juliet cross two si- or I'm sorry you're going to FedEx...you can continue on charlie you'll cross runway one eight left and then turn right on echo.

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
		0414:53.5 RDO-2	okay we're gonna take a right on charlie cross one eight left then uhh right on echo FedEx eleven seventy thanks for your help.
0415:02.5 HOT-2	clear right.		
0415:03.6 HOT-1	#.		
0415:09.4 RAAS	approaching zero eight. [electronic voice]		
0415:14.6 HOT-2	how did we # that up?		
0415:28.3 HOT-1	well...[throat clearing]		
0415:39.5 HOT-1	now we get to practice writing A-SAP reports.		
0415:43.7 HOT-2	[sigh]		
0415:58.2 HOT-1	God #.		
0416:44.3 HOT-2	all right we are clear to cross...one eight...left.		
0416:49.5 HOT-1	the one we shoulda been on.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0417:05.5 RAAS	approaching three six right. [electronic voice]		
0417:07.4 HOT-2	clear right.		
0417:21.1 HOT-1	all right come right on charlie.		
0417:23.6 HOT-2	concur.		
0417:28.4 HOT-2	clear right. after landing.		
0417:30.3 HOT-1	we're right on echo here.		
0417:32.3 HOT-2	lights.		
0417:33.9 HOT-1	that's what I meant to say.		
0417:36.8 HOT-2	terrain terrain. * brakes.		
0417:44.4 HOT-2	after landing checks complete.		
0417:47.1 HOT-1	all right. so you will need to do an A-SAP report.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0417:49.2 HOT-2	yup.		
0417:54.8 HOT-1	I don't like telling you what I am gonna to put in my report because I'd rather the A-SAP committee get two independent versions of what happened.		
0418:03.8 HOT-2	copy.		
0418:05.3 HOT-1	I'll call the D-O...when we get in.		
0418:16.8 HOT-1	so all you'll need to worry about is the A-SAP.		
0418:56.1 HOT-1	what are you looking up?		
0418:58.0 HOT-2	just the required reports- who we gotta talk to. you gotta call the D-O I guess.		
0419:01.9 HOT-1	yup.		
0419:02.5 HOT-2	all right.		
0419:12.3 HOT-2	clear right.		

Time and Source	Intra-Aircraft Communication	Time and Source	Over-the-Air Communication
0419:41.8 HOT-2	[sigh]		
0420:02.2 HOT-1	those cans look like they are all right.		
0420:04.5 HOT-2	yup. they are on the other side of the line-foul line. got wands up.		
0420:18.1 HOT-2	you're clear on the right.		
0421:16.8 HOT-1	all right. parking brake is set and holding. ice is off. right engine is coming down.		
0421:23.8 HOT-2	[sound of mumbling sigh]		
0421:50.8 CAM	[sound of quad beeper]		
0421:52.2 HOT-1	power selected on. ice is off. left engine is coming down.		
0421:52.2 END OF TRANSCRIPT			
0506:59.4 END OF RECORDING			